

THE INSTRUCTOR: Larry Constantine is a C-E-I-R, Inc., program consultant assigned to the C-E-I-R research and computation center at Boston, Mass. He is currently co-authoring a book titled "Structure and the Design of Programs." In addition to his systems work he is experienced in application of list processing techniques, business data processing, production of generalized programming packages, and graphic input and graphic display. He was responsible for the major portion of the design and programming for the NASA Launch Vehicle Model and directed implementation of the PERGO system, a major new project management tool which utilizes list processing techniques. His programming experience includes work with the IBM 1401, 7010, 7094, Univac 1107 and CDC 160-A. He is the author of "Elusis: Inductive Inference on the IBM 7094" and several magazine articles. Prior to his current assignment, he worked as programmer analyst at Scientific Computers, Inc., and as technical aide at the Massachusetts Institute of Technology Laboratory of Nuclear Science. Constantine is a member of the ACM and the Special Interest Committee on Symbolic and Algebraic Manipulation.

REGISTRATION: Tuition, including lunches and course materials, is \$220 for the first student and \$195 for others from the same organization. Checks should be made payable to C-E-I-R, Inc. Hotel accommodations are not included.

HOTEL ACCOMMODATIONS: The seminar is at the International Inn, 14th and M Streets, N.W., in Washington, D. C. A block of 25 single rooms at \$14 per night is being reserved by the International Inn for student use. These rooms will be held until two weeks prior to the seminar. Room reservation cards will be mailed with confirmation of registration.

OTHER COURSES: The C-E-I-R seminar program covers subjects in data processing and the management sciences. Among those now scheduled are:

- Computer Operations Management
- ALGOL for FORTRAN Programmers
- Project Planning
- List Processing
- Survey of Data Communications

For an outline of these courses, write:

Registrar
Institute for Advanced Technology
C-E-I-R^{INC}
1200 Jefferson Davis Highway
Arlington, Virginia 22202
(703) 684-6377

ADVANCED SYSTEM AND PROGRAM DESIGN

THE PROGRAMMING PROCESS

- Programming—definition
- The Process
 - Analysis: scope, approaches, personnel
 - Design: scope, approaches, why, consequences
 - Implementation: coding and debugging, language and machine problems, bit fiddling and other diseases
- Design in practice
- Programming facts and their effect on design

THE ECONOMICS OF PROGRAMS AND SYSTEMS

- Development Costs:
 - Lead work
 - Programming
 - Debugging
 - Documentation
- Operating Costs:
 - Raw run costs
 - Input preparation
 - Maintenance
 - Modification
- Other costs, some experiences, development / operations trade-offs, cost of duplicated effort

FOCUS ON DESIGN

- Program Design: compared and contrasted with other design processes
- Design decisions
- Criteria for decisions
- Form and method: definitions, distinctions, relative importance and historical emphasis
- Form-structure and organization
- Simple structure
- Advanced structural concepts: modularity, hierarchy, generality

MODULARITY

- Building blocks and units
- Concept of the "black-box"
- Macros, subroutines and other common modules
- Functional, logical, and conceptual modules

- Dependency, independency, and interdependency
- Design of modules individually and in systems
- Trade-offs: how much, what kind

HIERARCHY

- Hierarchy of structure and control
- Residence of control: executives, drivers, etc.
- Consistency and appropriateness of control
- Simultaneous and apparent control, interrupt processing
- Dynamic hierarchy and recursion, role of recursive procedures in good design
- Relation of hierarchy to problem definition, reduction of design scope
- Design: top down or bottom up? consequences

GENERALITY

- Misconceptions on cost of generalization
- Generalization as function of structure
- Some generalization techniques
 - Parameterizations
 - Formal Arguments
 - Inclusion/exclusion
 - Dummy routines, etc.
 - Removing restrictions
- Control of routines, programs and systems
 - Fixed
 - Inherent
 - Parameter driven
 - Table driven
 - Input controlled
 - Others
- Extendability and expandability
- Exceptions and exception procedures
- Decision structure, total decisions, error detection and handling, recovery procedure

UTILITY—THE USER INTERFACE

- Design for use
- Terminal characteristics
- Documentation
- Role of standards and conventions
- Operation characteristics, smooth flow

EFFICIENCY

- Optimization, pre-and-post
- Storage, speed, durability, and utility
- Special problems of systems programs
- A systems level approach

DURABILITY

- Debugging problems, completeness
- Design with debugging in mind
- Maintainability; determinants, solutions
- Modification, facility, extent
- Assurance and acceptance

PROBLEMS OF APPLICATIONS AND SYSTEMS PROGRAMS

- Definitions, distinctions
- Special problems
- Relative emphasis of design criteria
- More trade-offs

DESIGN AIDS AND DOCUMENTATION

- Available tools and aids
 - Flowcharts
 - Text
 - Decision tables
 - English/Algol pseudo-texts
- Relationships between design and documentation
- Hierarchical and segmented documentation

OVERVIEW AND SYNTHESIS

- Summary of Program Design
- Normative model for the design process
- Some right and some wrong decisions
- Examination of some existing systems
- Projections: Divergent views and some critical analysis

LOOKING BEYOND

THE NUTS AND BOLTS

OF PROGRAMMING

Dear Sir:

The measure of the professional programmer is not the number of special techniques he has mastered, but his ability to synthesize new tools and direct specific capabilities to specific problems.

These latter qualities of the programming professional are the subject of a new and unusual four-day seminar, Advanced Program and System Design.

This course is concerned with advanced general concepts of programming. Its content is drawn from valuable programming principles evolved over a period of years within a company whose primary activity is extending the useability of computers.

All the major aspects of advanced program and system design are covered during these four days. These include:

- Modularity--number and size of modules; interdependency; influence of modularity on the system as a whole.
- Hierarchy--depth of structure and control; order of the design process; interrupt processing and recursion.
- Generality--cost and methods of generalizing; extendability; impact of generality on utility, efficiency and durability.
- Utility--user interface; tradeoffs, and how much to allow.
- Efficiency--in terms of time and space; before and after design; new methods of optimization.

- Durability--reduction of maintenance and debugging; ease of modification.
- Tradeoffs and design tools--trading one characteristic for another; aids to the design process.

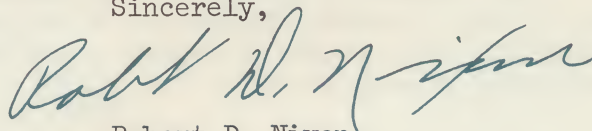
This presentation is not oriented to any specific language or computer, but to problems and approaches common to all programming. Special emphasis is placed on comparing and contrasting design problems in system and application programming.

Larry Constantine, a C-E-I-R programming consultant and experienced seminar instructor, was chosen to develop and teach this seminar. Larry is known for his concern for economic justification of principles of design, and has created a seminar that emphasizes immediately applicable principles. He is co-authoring a text on "Structure and the Design of Programs," and his article "Toward a Theory of Program Design" appeared in the December issue of Data Processing Magazine.

His emphasis on economic justification of programming in this seminar on advanced methods is intended to help the student return to his organization, after four days of intensive study, with information and ideas that produce better programs at measurably lower cost.

This seminar, like others in the C-E-I-R program, will be limited to some thirty students. To assure yourself of a place at the August 22-24 class at the new International Inn in Washington, D. C., call the IAT registrar today or mail the enclosed registration card.

Sincerely,



Robert D. Nixon
Director of Curriculum

BUSINESS REPLY MAIL

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POSTAGE WILL BE PAID BY ADDRESSEE

**Registrar
Institute for Advanced Technology
C-E-I-R, Inc,
1200 Jefferson Davis Highway
Arlington, Virginia**

FIRST CLASS
PERMIT NO. 35700
WASHINGTON, D. C.

INSTITUTE FOR ADVANCED TECHNOLOGY

1200 JEFFERSON DAVIS HIGHWAY • ARLINGTON, VIRGINIA 22202 • (703) 684-6377

A DO-IT-YOURSELF

APPROACH TO LEARNING

ALGOL PROGRAMMING

Dear Sir:

This is a seminar for programmers--specifically, programmers with experience in FORTRAN. The subject of the three-day course is the ALGOL language, and some may be surprised to find that:

- There are more computers around with ALGOL capability than you'd think. . . and even more on the way, and
- Our approach to teaching this language involves extensive student use of C-E-I-R's time-sharing system.

The programmer who asks "I know FORTRAN, so why bother with ALGOL?" is like the motorist who lives in Montreal and figures he can get along without snow tires or chains. He may be right--more than half of the time.

The man we're after with this seminar is the programming professional who wants to master ALGOL not just so that he can read algorithms in technical publications, but because he recognizes ALGOL as a language that will prove useful to him with certain types of problems he encounters in the daily practice of his craft.

This man just might not be aware of the growing number of computers for which ALGOL compilers are available. The list below gives an indication of the current situation:

MANUFACTURER

MODEL

GE	235, 645
IBM	7070, 7090, 360/40
SDS	925, 930, 950
Burroughs	205, 220, B5500
CDC	1604, 3600, 3800, 6600
UNIVAC	1105, 1107/8, UNIVAC III
RCA	601 and licencees: Siemens, Hitachi and English Electric
DEC	PDP-1

Not listed above are literally dozens of overseas computers with ALGOL compilers. ALGOL is not just an international computing language; it is the most commonly used computer language in Europe, Japan, and elsewhere. As such, it's a handy thing to know for the data processing man who works in an international organization.

The approach we take, in the "ALGOL for FORTRAN Programmers" seminar is based on the belief that an experienced FORTRAN programmer will learn more, learn better, and learn faster by USING the ALGOL language than he will in a lecture room. That's why we've moved the classroom as close as possible to our computer center in Arlington (across the river from Washington, D. C.)

Lectures will take up about one third of the three-day seminar. Two-thirds will be devoted to workshop sessions in which each student will program, debug, and run his programs, using consoles linked to C-E-I-R's time-sharing system. (It employs Teletype input via phone lines to our GE235/Datanet 30 installation).

The seminar concludes with a review of ALGOL's development; major advantages and disadvantages of ALGOL and FORTRAN, and consideration of the practical issues of usefulness and appropriateness.

About six terminals will be available for student use to assure everybody ample console time. We've tried this "learn-by-doing" approach in another programming seminar, and it works. This time, with several more consoles for student use, we're confident that it will work even better.

Attendance at this seminar, given August 15, 16, 17 at the Marriott Motor Hotel and C-E-I-R's Arlington, Virginia, computer center, will be limited to a class of about thirty. Additional sessions may be scheduled later on. To be sure you are among those present and accounted for at this interesting and productive session, mail or phone your registration today.

Sincerely,



Robert D. Nixon
Director of Curriculum

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1200 Jefferson Davis Highway
Arlington, Virginia

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ALGOL FOR FORTRAN PROGRAMMERS

A Three-Day Seminar

This is a seminar for programmers with FORTRAN experience who are interested in the advantages that are often present through use of the ALGOL programming language. The basic assumption is that this programming professional will learn more, learn faster, and learn better by using the language than by hearing about it in lecture. To make this possible, the emphasis is on workshop sessions in which the student writes and runs ALGOL programs, using the C-E-I-R time sharing facility. The seminar will give this programmer a working knowledge of a language that is available on a surprising number of machines; the ability to take advantage of the efficiencies often possible through use of ALGOL, and an opportunity to evaluate the language in relation to others now available to him. Tuition, including luncheons and course material, is \$195 for the first student and \$175 for others from the same organization.

Marriott Motor Hotel
Arlington, Virginia
August 15-16-17

Register me for **ALGOL FOR FORTRAN PROGRAMMERS**

NAME: _____

TITLE: _____

COMPANY: _____

ADDRESS: _____

PHONE: _____

Please Register This Additional Student

NAME: _____

TITLE: _____

CHECK ENCLOSED ☐

BILL MY COMPANY ☐

THE INSTRUCTORS

Marjorie Lindsay Kimbrough is a C-E-I-R consultant with seven years' experience in mathematical analysis and computer programming. Her background includes work with Lockheed-California and Burroughs Corporation. As a mathematical engineer with Lockheed-California she developed and programmed numerical methods for solution on the IBM 7090 of technical engineering problems in spacecraft, aerodynamics, operations, and research and development. As a systems representative with Burroughs she was responsible for all technical support at the Georgia Institute of Technology B5500 installation and, among her other assignments, was responsible for developing and teaching courses in ALGOL, FORTRAN, and COBOL. She is a graduate of the University of California at Berkeley, where she majored in mathematics and was a member of Phi Beta Kappa.

Toby Riley is a C-E-I-R senior consultant in program development who has more than ten years experience in the field of computer sciences. He has served as project director for such large-scale programs as Du Pont's RAMPS (8,500 FORTRAN statements) and the NASA Launch Vehicle Model. During his experience with both IBM and C-E-I-R, Riley has programmed on all the IBM 1400 and 7000 series computers, as well as several systems in the UNIVAC Scientific series, and Burroughs, GE, and RCA computers. Riley received his undergraduate degree from Swarthmore and has completed two years of graduate studies at the Case Institute of Technology.

REGISTRATION: Tuition, including luncheons and course materials, is \$195 for the first student and \$175 for others from the same organization. Checks for tuition should be made payable to C-E-I-R, Inc. The seminar is intended for a group of about thirty students. Classes begin at 9 a.m. and continue through 5 p.m. Hotel rooms are not included.

HOTEL ACCOMMODATIONS: The seminar is at the Marriott Motor Hotel on U.S. 1 near the Washington National Airport. A block of rooms at \$15 per night is being reserved by the hotel for student use. These will be held until two weeks prior to the seminar. Room reservation cards will be mailed with confirmation of your registration for the seminar.

OTHER COURSES: Among those currently scheduled are:

LIST PROCESSING: An introduction to list processing and structured data. New York City. July 18-19-20.

COMPUTER OPERATIONS MANAGEMENT: Review of basics for center managers and those who will be managers. Washington, D.C., August 3-4-5.

DOCUMENTATION & DEBUGGING: Examines current practice and suggests operating standards. Washington, D.C., July 26-27-28-29.

For information about these or other seminars in the C-E-I-R program, write:

Registrar
Institute for Advanced Technology
C-E-I-R^{INC}
1200 Jefferson Davis Highway
Arlington, Virginia 22202
Phone: Area Code 703/684-6377

ALGOL for FORTRAN Programmers

A Three-Day Seminar
August 15-16-17
Marriott Motor Hotel
Arlington, Virginia

This is a seminar for programmers with FORTRAN experience who are interested in the advantages that are often present through use of the ALGOL programming language. The basic assumption is that this programming professional will learn more, learn faster, and learn better by using the language than by hearing about it in lecture. To make this possible, the emphasis is on working sessions in which the student writes and runs ALGOL programs, using the C-E-I-R time sharing facility. The seminar will give this programmer a working knowledge of a language that is available on a surprising number of machines; the ability to take advantage of the efficiencies often possible through use of ALGOL, and an opportunity to evaluate the language in relation to others now available to him. Tuition, including luncheons and course materials, is \$195 for the first student and \$175 for others from the same organization.

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ALGOL FOR FORTRAN PROGRAMMERS

Course Outline

The ALGOL Language

Introduction and use

The bare essentials for using the Dartmouth ALGOL in the C-E-I-R time-sharing mode

The important similarities in:

The expanded character set, and syntax

Variables, constants, and arithmetic expressions

The ALGOL Program

Program structures compared: declarations, statements, and blocks.

The case for more powerful control statements:

IF statements contrasted
Switch declarations
Labels

The handling of iterations (switching from DO's to FOR's):

The more powerful FOR lists
FOR statements and their variations

Arrays and subscripts contrasted

The more general array declarations
Subscripting in ALGOL

Program segmentation:

procedures vs. subroutines

Subprograms

Formal and actual parameters

Input/Output Statements and data handling

The history of ALGOL as a guide to its development

The major advantages and disadvantages of ALGOL and FORTRAN compared

The practical issues of usefulness and appropriateness: efficiencies of coding, generated code, space and speed

ALGOL as a publication language

A critique of current ALGOL implementations

C-E-I-R^{INC} is an international applied research and data processing corporation that offers analytical, scientific and computer services to business, science and government. Founded in 1954, it is today the world's largest, most experienced and best equipped independent organization in its field. The C-E-I-R professional staff includes several hundred mathematicians, statisticians, economists, operations researchers, management scientists and others from a variety of disciplines. In addition, many of the finest scientific and professional men in America are retained on a consultant basis. Augmenting this professional capability are modern electronic computing equipment, and skilled computer programmers and operations personnel at computing centers in five major U.S. cities, London, The Hague and Mexico City.



IAT is the latest expression of C-E-I-R's long-standing involvement in management education. The revolutionary nature of computer-based methods made education an integral part of C-E-I-R operations from the beginning. This relationship is formalized through the Institute for Advanced Technology. IAT faculty members are drawn primarily from the ranks of C-E-I-R's professional and computer operations staffs. Its curriculum is drawn from subjects in which C-E-I-R staff members are expert—recognized for excellence in day-to-day application of the art and science of computer usage to the real problems of C-E-I-R customers in business and industry. Sharing these new skills through seminars in major cities, management clinics, and special, in-plant training programs is the major goal of the Institute for Advanced Technology.